Atlantic Richfield Company
Atlantic Richfield Company

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Direct: (714) 228-6770

March 4, 2015

Mr. Steven Way
On-Scene Coordinator
Emergency Response Program (8EPR-SA)
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Delivered via e-mail

Subject: February 2015 Monthly Progress Report
Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01, Rico, Colorado

Dear Mr. Way,

This progress report describes activities conducted during the month of February, 2015 at the Rico-Argentine Mine Site (site) and activities anticipated to occur during the upcoming month. These activities are organized by task as identified in the Removal Action Work Plan. This progress report is being submitted in accordance with Paragraph 35.a of the Unilateral Administrative Order for Removal Action (the "UAO"), dated March 17, 2011 (effective March 23, 2011).

ACTIVITIES FOR FEBRUARY

This section describes significant developments during the preceding period including actions performed and any problems encountered during this reporting period. A summary of the St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study system performance is provided as an attachment.

Site-Wide Activities

- Collected snow pit information for site avalanche hazard forecasting to facilitate safe winter access.
- Maintained winter access routes for winter sampling and monitoring activities.
- Monitored site for major security and functionality breaches.
- Start work to develop a revised UAO schedule for submission to EPA by March 6, 2015.

Task A – Pre-Design and Ongoing Site Monitoring

- Performed additional evaluation of potential improvements to surface water flow data gathering and telemetry. Continued working with Town of Rico on the application for an antenna permit.
- Collected data from pressure transducers at DR-3, DR-6, and AT-2. Collected manual flow measurements from DR-3 and DR-6.
- Inspected the St. Louis Ponds System, pond water levels, free-board, and condition of outlet pipes and overflow spillways. The pond network appears to be flowing well and in good condition.
- Completed remaining low flow sampling event activities that included the following:
    - Collected water samples, field water quality parameters, and water level measurements from groundwater wells GW-1, GW-3, GW-4, GW-6, EB-1, EB-2, MW-1 DEEP, MW-1 SHALLOW, MW-2 DEEP, MW-3 DEEP, MW-4 DEEP, MW-4 SHALLOW, MW-5 DEEP, MW-5 SHALLOW, MW-6 DEEP, MW-6 SHALLOW, MW-103, MW-104, MW-105, MW-

106, MW-107, MW-108D, MW-108S, MW-109S, MW-110, MW-208, P13-102, P13-103, PZ-1, and PZ-2, as well as angle borehole BAH-01.
  - Collected groundwater elevations only from wells MW-2 SHALLOW and MW-3 SHALLOW. There was insufficient water depth to collect samples.
  - Collected water samples and field water quality parameters at surface water locations DR-1, DR-2, DR-3, DR-4, DR-5, DR-6, DR-7, DR-4-SW, and DR-G.
  - Collected quality control matrix spike and matrix spike duplicate samples MS-1, MSD-1, MS-3, and MSD-3.
  - Collected quality control equipment blank sample EQB-2 following decontamination of submersible pump.
  - Collected quality control field blank samples FB-1, FB-2, FB-3, and FB-4.
  - Collected quality control field duplicate samples DR-8 at sampling location DR-7, DR-10 at sampling location PZ-1, DR-11 at sampling location MW-5 DEEP, DR-12 at sampling location MW-109S, and DR-13 at sampling location GW-1.
  - Calibrated and serviced data loggers and transducers.

Task B – Management of Precipitation Solids in the Upper Settling Ponds

- Routed the St. Louis Tunnel discharge to Pond 18 during the month of February, 2015.
- Continued planning for removal of remaining mining/mineral processing by-products from Upper Ponds.

Task C – Design and Construction of a Solids Repository

- Provided public notice of the March 16, 2015 public hearing with the Dolores County Board of County Commissioners (BOCC), which was rescheduled from February 17, 2015. Notice sent by mail, published in a local newspaper, and posted at the intersection of St. Louis Road and State Highway 145.
- Initiated planning for re-mobilization and completion of repository construction during the 2015 field season.
- Continued work for interim management of mining/mineral processing by-products until final disposal in the Phase 1 Solids Repository.
- Continued work on final design of a reconfigured Interim Drying Facility (IDF).

Task D – Hydraulic Control Measures for the Collapsed Area of St. Louis Tunnel Adit

- Continued design work on Stage 2 (including 60% drawings and specifications) for the St. Louis Tunnel hydraulic control system.
- Monitored water levels in the tunnel at AT-2 using the data logger.
- Downloaded flow measurement data from pressure transducer at AT-2.

Task E – Source Water Investigations and Controls

- Continued Blaine Tunnel water depth and flow monitoring behind the Blaine Coffer Dam at the Blaine Tunnel Flume.

Task F – Water Treatment System Analysis and Design

- Completed two sampling events during the month of February 2015.
- Continued design work (including 60% drawings and specifications) on Enhanced Wetland Demonstration System.
- Completed H_2S monitoring throughout the month and calibrated units.

ACTIVITIES FOR UPCOMING MONTH

This section describes developments expected to occur during the upcoming reporting period, including a schedule of work to be performed, anticipated problems, and planned resolution of past or anticipated problems.

Site-Wide Activities

- Maintain winter access routes for sampling and monitoring of the Demonstration Wetland.
- Perform ongoing security observation of the site.
- Collect snow pit information for site avalanche hazard forecast.
- Submit revised UAO schedule to EPA by March 6, 2015.

Task A – Pre-Design and Ongoing Site Monitoring

- Inspect the St. Louis Ponds System, water levels, and free-board.
- Continue work on submittal and processing of the application for a telemetry antenna permit for the Rico office building.

Task B – Management of Precipitation Solids in the Upper Settling Ponds

- Continue routing St. Louis Tunnel discharge to Pond 18.
- Continue planning for removal of all remaining mining/mineral processing by-products from Upper Ponds.

Task C – Design and Construction of a Solids Repository

- Participate in the March 16, 2015 public hearing at 11 am with the Dolores County BOCC in Dove Creek, Colorado.
- Continue planning for re-mobilization and completion of repository construction during the 2015 field season.
- Continue work for interim management of mining/mineral processing by-products until final disposal in the Phase 1 Solids Repository.
- Continue work on final design of a reconfigured Interim Drying Facility (IDF).

Task D – Hydraulic Control Measures for the Collapsed Area of St. Louis Tunnel Adit

- Continue work on design of Stage 2 (including 60% drawings and specifications) hydraulic control measures.
- Monitor water levels in the tunnel at AT-2.

Task E – Source Water Investigations and Controls

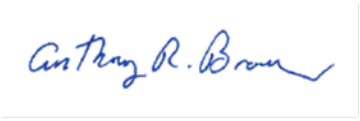
- Continue Blaine Tunnel water depth and flow monitoring behind the Blaine Coffer Dam at the Blaine Tunnel Flume.

Task F – Water Treatment System Analysis and Design

- Continue scoping additional data needs as necessary related to treatment system alternatives.
- Continue design of the Enhanced Wetland Demonstration System.
- Perform winter operations and sampling of the Demonstration Scale Wetlands twice per month, weather and site conditions permitting.

If you have any questions, please feel free to contact me at (951) 265-4277.

Sincerely,



Anthony R. Brown
Project Manager
Atlantic Richfield Company

cc: R. Halsey, Atlantic Richfield
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A. Piggott, Esq., U.S. EPA
D. McCarthy, Copper Environmental
K. Sessions, AEEC
C. Hixenbaugh, AEEC
B. Florentin, AMEC

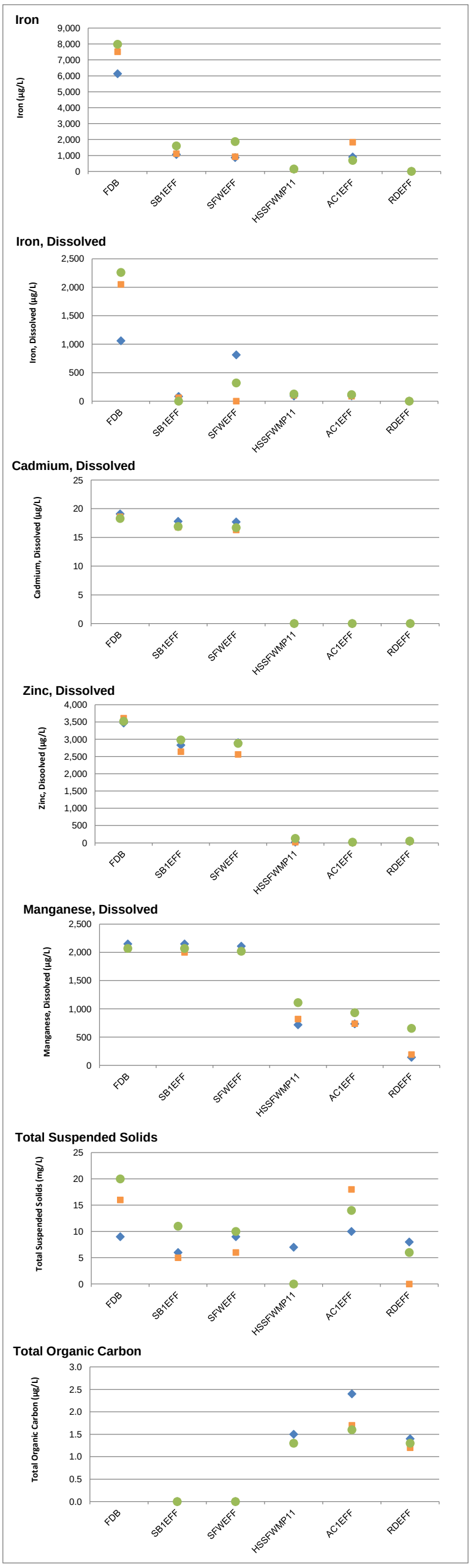
file: Atlantic Richfield Rico Archives, La Palma, CA
AECOM Denver Project File

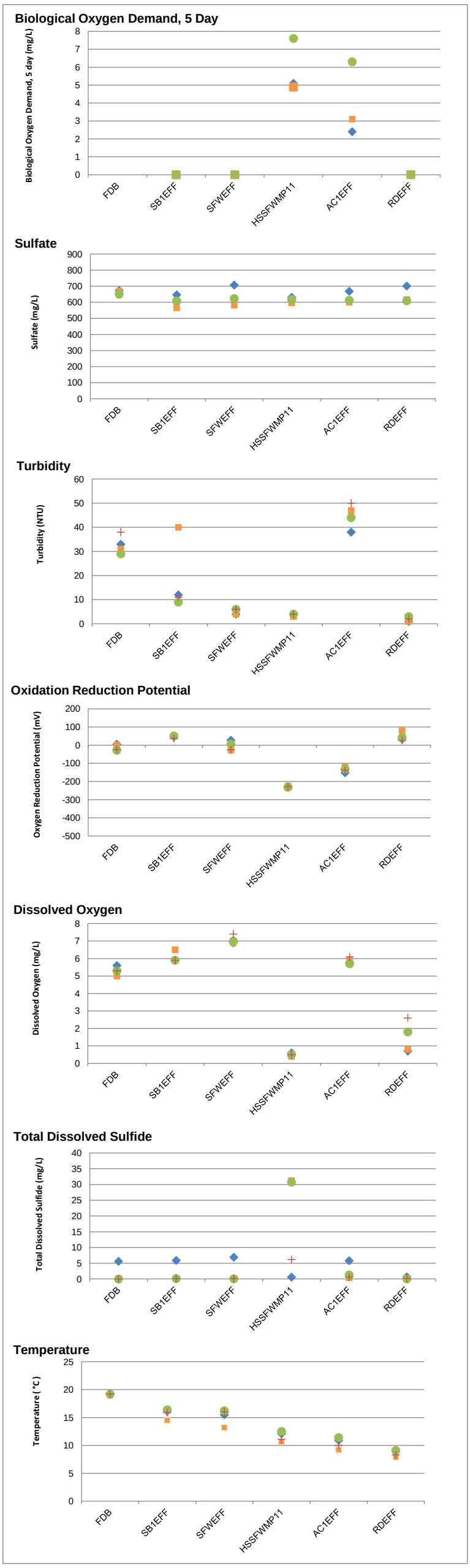
Attachment

Key Performance Indicators Figures

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01





Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

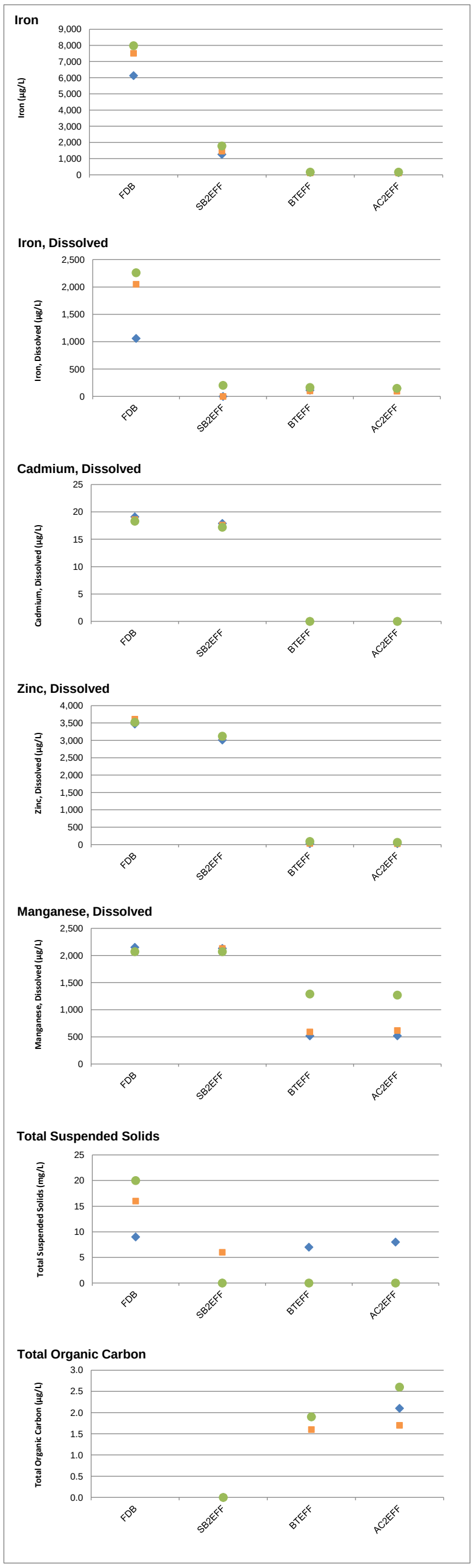
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
CWDTS = Constructed Wetland Demonstration Treatability Study
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
HWTT = Horizontal Wetland Treatment Train
RDEFF = Rock Drain Effluent
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

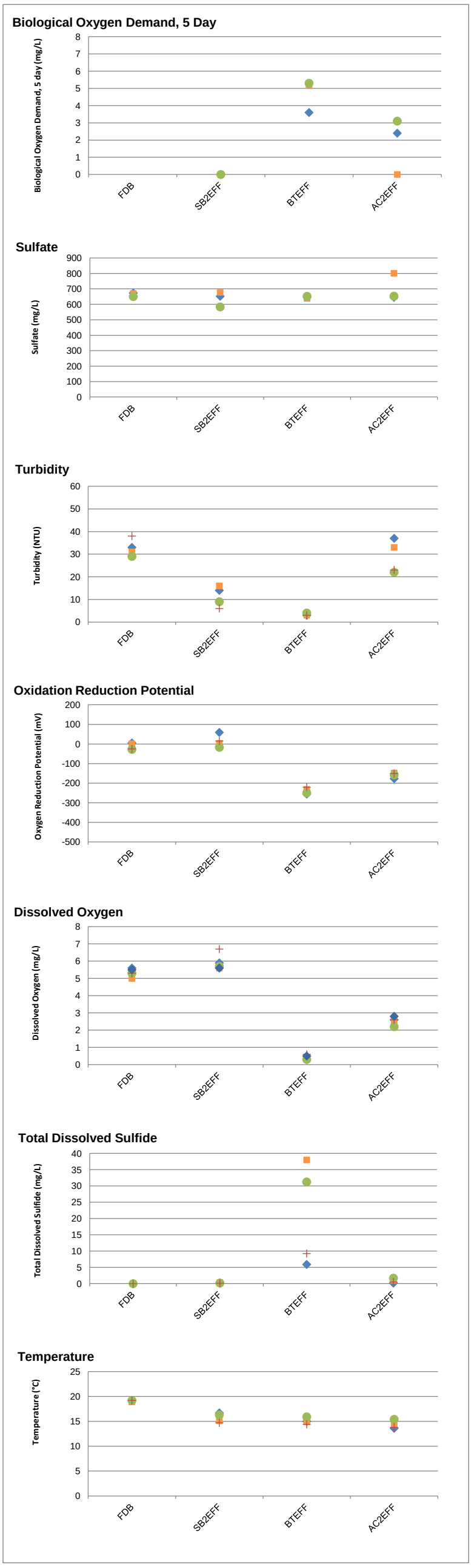
C = Degrees Celsius
µg/L = micrograms per liter
mg/L = milligrams per liter
mV = millivolts
NTU = Nephelometric Turbidity Units
RL = Reporting Limit
TR01 = Testing Phase Test Run 01
TR01 W** = Week of Testing Phase Test Run 01

◆ TR01 W00, 22.7 gpm ■ TR01 W02, 20.4 gpm
● TR01 W04, 27.0 gpm + TR01 W06, 28.7 gpm

FIGURE 1
HWTT Key Performance Indicators Spatial Series TR01
St. Louis Tunnel Discharge CWDTS
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

2/27/2015





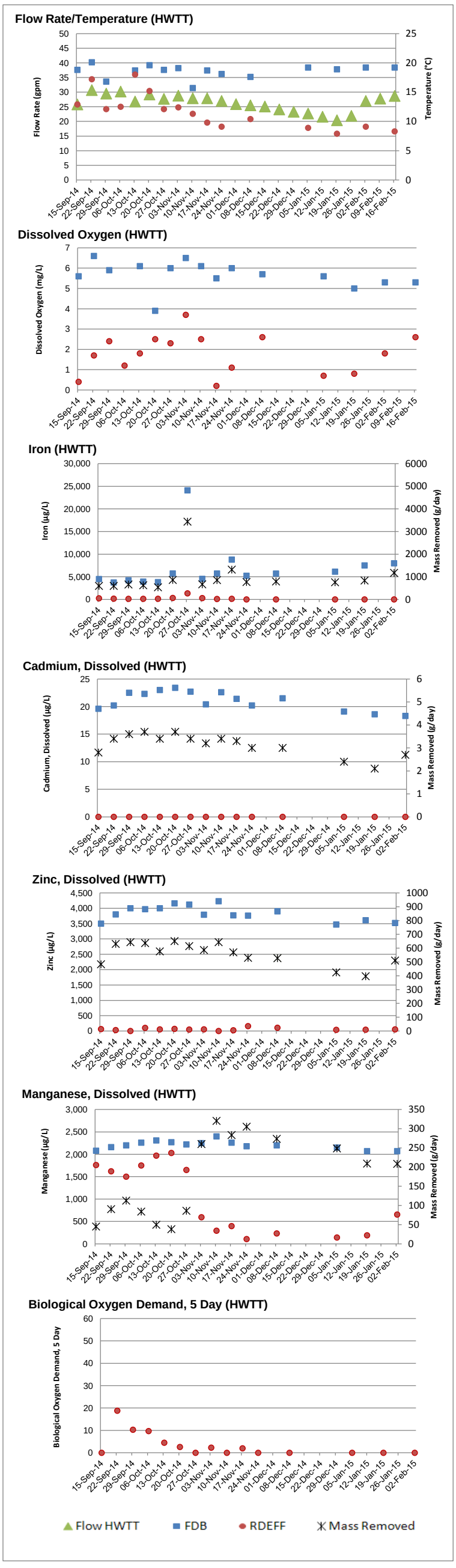
Non-detects are reported as less than the laboratory RL and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).
Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

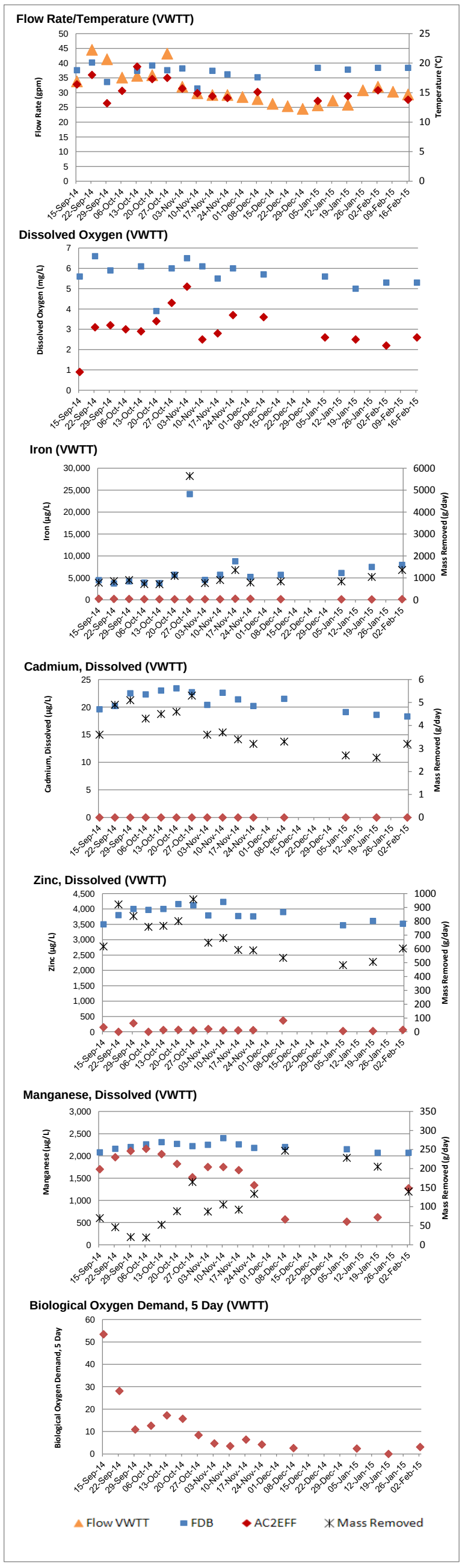
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
CWDTS = Constructed Wetland Demonstration Treatability Study
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
VWTT = Vertical Wetland Treatment Train

C = Degrees Celsius
µg/L = micrograms per liter
mg/L = milligrams per liter
mV = millivolts
NTU = Nephelometric Turbidity Units
RL = Reporting Limit
TR01 = Testing Phase Test Run 01
TR01 W** = Week of Testing Phase Test Run 01

FIGURE 2
VWTT Key Performance Indicators Spatial Series TR01
St. Louis Tunnel Discharge CWDTS
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

2/27/2015





Non-detects are reported as less than the laboratory RL and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

The Aeration Cascade in the VWTT train was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

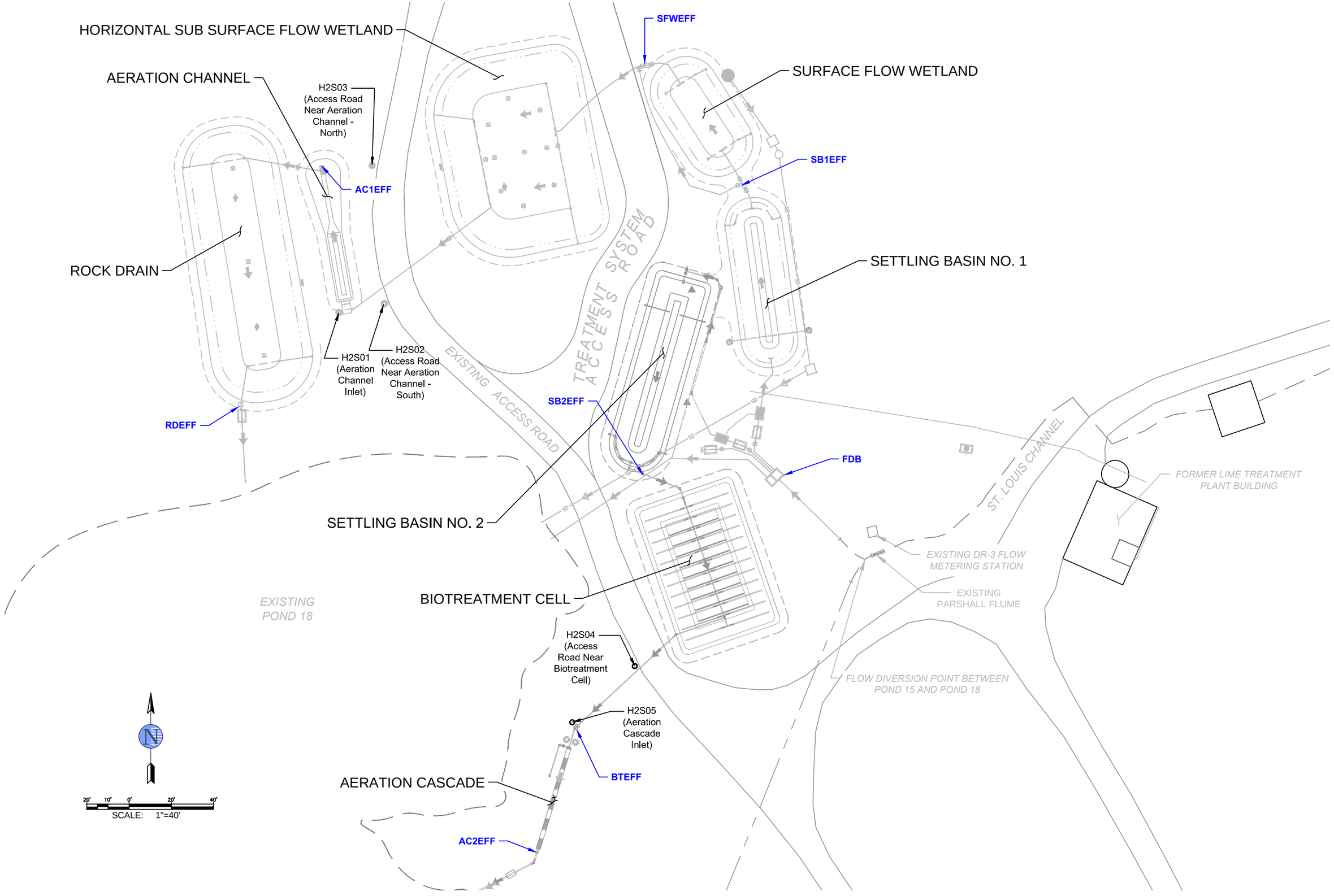
AC2EFF = Aeration Cascade Effluent
C = Degrees Celsius
µg/L = micrograms per liter
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
gpm = gallons per minute
g/day = grams per day
HWTT = Horizontal Wetland Treatment Train
mg/L = milligrams per liter
mV = millivolts
NTU = Nephelometric Turbidity Units
RDEFF = Rock Drain Effluent
RL = Reporting Limit
VWTT = Vertical Wetland Treatment Train

FIGURE 3

HWTT/VWTT Key Performance Indicators Time Series

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01



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CHECKED:	LPCjr
REVIEWED:	KS
APPROVED:	KS
JOB No:	1300
CAD FILE:	Figure 4.dwg

DESCRIPTION | DATE | REV

RESOURCE MANAGEMENT CONSULTANTS
8138 SOUTH STATE ST.
SUITE 2A
MIDVALE, UT 84047
801-255-2626

RICO - ARGENTINE MINE SITE
ST LOUIS DISCHARGE CWDTS

Monthly Progress Report
Monitoring Locations

AEEC
www.americanconsultants.com
3489 W 2100 S, Salt Lake City, UT 84119
801-908-5447 Fax 801-972-2741

DATE:	01 DEC 14
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Figure 4

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Key Performance Indicators Tables

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Table 1. Iron (µg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	4500	1330	1200	223	261	250	1250	266	246
C	W01	22-Sep-14	30.7	44.5	3740	1070	930	168	203	170	971	206	218
C	W02	29-Sep-14	29.5	41.3	4230	1640	1360	194	250	129	1440	216	210
C	W03	06-Oct-14	30.2	35.1	3940	1720	1540	142	156	134	937	171	165
C	W04	13-Oct-14	26.8	35.7	3820	892	900	146	138	144	1500	161	154
C	W05	20-Oct-14	29.2	35.9	5730	1260	1010	133	1010	326	1390	244	143
C	W06	27-Oct-14	27.7	43.2	24100	1630	1330	171	304	1340	R	157	137
C	W07	03-Nov-14	28.8	32.0	4550	1180	1130	126	118	297	902	175	153
C	W08	10-Nov-14	27.9	29.8	5720	1540	1380	137	115	99.6	1640	151	148
C	W09	17-Nov-14	27.9	29.2	8800	978	1190	218	2140	141	1670	253	260
C	W10	24-Nov-14	27.0	29.2	5230	1550	1270	135	712	<50	1850	236	245
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	5710	1490	1280	129	538	<50	1320	164	156
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	6130	1060	867	129	905	<50	1260	151	131
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	7510	1110	920	117	1830	<50	1460	116	109
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	7980	1600	1870	150	688	<50	1780	164	162

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = horizontal treatment train average flow rate
Flow V = vertical treatment train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NS = not sampled
OU = operable unit
RDEFF = Rock Drain Effluent
R = rejected
RL = reporting limit
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
µg/L = microgram per liter
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 2. Iron, Dissolved (µg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	772	56.4	<50	80.7	50.8	76.2	101	213	174
C	W01	22-Sep-14	30.7	44.5	723	<50	182	56	<50	<50	96.2	172	128
C	W02	29-Sep-14	29.5	41.3	1320	140	<50	74.1	<50	<50	166	189	147
C	W03	06-Oct-14	30.2	35.1	625	120	<50	79.8	<50	53.3	360	147	86.2
C	W04	13-Oct-14	26.8	35.7	339	58.2	<50	77	52.8	66.1	67	135	89.4
C	W05	20-Oct-14	29.2	35.9	575	96	<50	78.9	103	195	72.8	128	106
C	W06	27-Oct-14	27.7	43.2	1930	252	64.6	123	113	847	R	140	113
C	W07	03-Nov-14	28.8	32.0	483	113	59.9	122	80.5	148	66.4	143	106
C	W08	10-Nov-14	27.9	29.8	2290	329	67.6	126	64.4	79.8	147	134	90
C	W09	17-Nov-14	27.9	29.2	1140	152	54.6	101	79.2	111	154	215	188
C	W10	24-Nov-14	27.0	29.2	3480	167	73.4	85.4	168	<50	119	194	163
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	5510	1470	1360	130	454	<50	1330	167	161
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	1060	82.9	813	91.7	92	<50	<50	113	148
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	2050	60.4	<50	103	86.9	<50	<50	102	95.6
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	2260	<50	320	126	115	<50	202	164	148

NOTES:

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AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

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Table 3. Cadmium, Dissolved (µg/L)
Horizontal and Vertical Wetland Treatment Trains
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Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	19.6	18.9	18.4	<0.5	<0.5	<0.5	19.1	<0.5	<0.5
C	W01	22-Sep-14	30.7	44.5	20.2	19.4	19	<0.5	<0.5	<0.5	18.8	<0.5	<0.5
C	W02	29-Sep-14	29.5	41.3	22.5	21.2	20.4	<0.5	<0.5	<0.5	21.2	<0.5	<0.5
C	W03	06-Oct-14	30.2	35.1	22.3	21.5	21	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W04	13-Oct-14	26.8	35.7	23	21.9	20.7	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W05	20-Oct-14	29.2	35.9	23.4	23.6	23.6	0.6	<0.5	<0.5	24.1	<0.5	<0.5
C	W06	27-Oct-14	27.7	43.2	22.7	21.9	21.6	<0.5	<0.5	<0.5	R	<0.5	<0.5
C	W07	03-Nov-14	28.8	32.0	20.4	21.2	21.1	1.1	0.51	<0.5	21.6	<0.5	<0.5
C	W08	10-Nov-14	27.9	29.8	22.6	21.9	21.4	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W09	17-Nov-14	27.9	29.2	21.4	20	20	<0.5	<0.5	<0.5	20.7	<0.5	<0.5
C	W10	24-Nov-14	27.0	29.2	20.2	19	19.2	<0.5	<0.5	<0.5	19	<0.5	<0.5
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	21.5	20	19.7	1.1	1	<0.5	19.6	<0.5	<0.5
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	19.1	17.8	17.7	<0.5	<0.5	<0.5	17.9	<0.5	<0.5
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	18.6	16.8	16.3	<0.5	<0.5	<0.5	17.6	<0.5	<0.5
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	18.3	16.9	16.7	<0.5	<0.5	<0.5	17.2	<0.5	<0.5

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = horizontal treatment train average flow rate
Flow V = vertical treatment train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NS = not sampled
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
RL = reporting limit
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
µg/L = microgram per liter
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 4. Zinc, Dissolved (µg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	3500	3140	3020	60.6	<10	62.5	3120	52 J	148
C	W01	22-Sep-14	30.7	44.5	3800 J	3240	3210	<10	27	30	3100	12.8	<10
C	W02	29-Sep-14	29.5	41.3	4000	3520	3320	30.3	<10	<10	3450 J	10.8	279
C	W03	06-Oct-14	30.2	35.1	3970	3570	3440	115	37.9	102	3530	32.7	<10
C	W04	13-Oct-14	26.8	35.7	4000	3360	3060	90.4	60.5	53	3650	76.2	59.4
C	W05	20-Oct-14	29.2	35.9	4160	3610	3560	156	70	69.3	3840	56.4	65.7
C	W06	27-Oct-14	27.7	43.2	4120	3690	3530	79.9	47.8	47.9	R	<10	46.9
C	W07	03-Nov-14	28.8	32.0	3790	3460	3340	391	190	54	3650	83.3	91.7
C	W08	10-Nov-14	27.9	29.8	4230	3740	3590	152	48.3	<10	3810	15.2	49.4
C	W09	17-Nov-14	27.9	29.2	3770	3260	3370	74	44.1	23.5	3500	50.5	48.8
C	W10	24-Nov-14	27.0	29.2	3760	3220	3170	105	168	159	3320	41.8	54.5
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	3900	3350	3350	503	439	106	3430	380	368
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	3470	2830	2900	21.5	15.3	38.3	3010 J	26.9	26.1
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	3610	2640	2560	20.7	11.1	42.7	3100	33.5	25.3
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	3520	2980	2880	129	20.5	52.9	3120	89.4	63.7

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 5. Manganese, Dissolved (µg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	2080	2100	2040 J	1730 J	1610	1760	2110	1690	1700
C	W01	22-Sep-14	30.7	44.5	2160 J	2100	2110	1860 J	1630	1620	2110	2000	1970
C	W02	29-Sep-14	29.5	41.3	2200	2200	2100	1800	1660	1500	2140 J	2170 J	2110
C	W03	06-Oct-14	30.2	35.1	2260	2250	2230	1930	1840	1750 J	2280	2220 J	2160
C	W04	13-Oct-14	26.8	35.7	2310 B	2310 B	2180 B	2000 B	1950 B	1970 B	2310 B	2030 B	2040 B
C	W05	20-Oct-14	29.2	35.9	2270	2440	2370	2000 J	1990	2030	2360	1780	1820
C	W06	27-Oct-14	27.7	43.2	2220	2300	2240	1960	1950	1650 J	R	1470	1520
C	W07	03-Nov-14	28.8	32.0	2250	2260	2270	1490	1540	594 J	2270	1750	1750
C	W08	10-Nov-14	27.9	29.8	2400	2430	2390	1080	1280	293 J	2300 J	1690 J	1750
C	W09	17-Nov-14	27.9	29.2	2260	2240	2340	904 J	1020	396 J	2220	1670	1680
C	W10	24-Nov-14	27.0	29.2	2180	2170	2160	695 J	843	106 J	2110	1410	1340
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	2200	2220	2200	686	825	232	2200	568	571
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	2150	2150	2110	717	734	141	2130 J	519	520
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	2070	2000	2020	819 J	737	190	2130	592 J	618
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	2070	2070	2020	1110	931	654	2070	1290	1270

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
B = Laboratory flag indicating blank contamination
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = horizontal treatment train average flow rate
Flow V = vertical treatment train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.
MDL = method detection limit
NS = not sampled
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
RL = reporting limit
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
µg/L = microgram per liter
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 6. Total Suspended Solids (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	6	<5	<5	<5	<5	<5	<5	<5	<5
C	W01	22-Sep-14	30.7	44.5	6	12	<5	<5	6	<5	<5	<5	<5
C	W02	29-Sep-14	29.5	41.3	8	<5	6	<5	10	<5	9	<5	<5
C	W03	06-Oct-14	30.2	35.1	<5	<5	6	<5	<5	<5	<5	<5	<5
C	W04	13-Oct-14	26.8	35.7	11	10	14	<5	5	<5	15	<5	<5
C	W05	20-Oct-14	29.2	35.9	17	7	9	<5	22	<5	12	6	12
C	W06	27-Oct-14	27.7	43.2	<5	7	<5	<5	<5	5	R	<5	<5
C	W07	03-Nov-14	28.8	32.0	11	6	8	<5	<5	<5	<5	<5	<5
C	W08	10-Nov-14	27.9	29.8	<5	7	6	<5	<5	<5	11	5	10
C	W09	17-Nov-14	27.9	29.2	12	13	15	80	30	11	15	<5	14
C	W10	24-Nov-14	27.0	29.2	42	10	7	<5	15	<5	7	6	14
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	14	9	<5	<5	<5	<5	<5	<5	<5
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	9	6	9	7	10	8	<5	7	8
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	16	5	6	<5	18	<5	6	<5	<5
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	20	11	10	<5	14	6	<5	<5	<5

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

mg/L = milligram per liter

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 7. Total Organic Carbon (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	NR	<1	<1	12.7	24.9	21.5	<1	38	31.6
C	W01	22-Sep-14	30.7	44.5	NR	1.3	<1	6.8	11.7	12.5	1	21	19.7
C	W02	29-Sep-14	29.5	41.3	NR	<1	<1	5.9	9	9.1	1.3	10.6	9.2
C	W03	06-Oct-14	30.2	35.1	NR	<1	<1	4.2	7.4	7.6	<1	9.2	7.8
C	W04	13-Oct-14	26.8	35.7	NR	<1	<1	3.2	4.9	5.2	1.1	6.2 J	5.3
C	W05	20-Oct-14	29.2	35.9	NR	<1	<1	3	4.2	4.4	<1	4.6	4.4
C	W06	27-Oct-14	27.7	43.2	NR	<1	<1	2.9	4	6.5	R	3.5	3.3
C	W07	03-Nov-14	28.8	32.0	NR	<1	<1	1.6	2.6	2.5	<1	2.6	2.6
C	W08	10-Nov-14	27.9	29.8	NR	<1	<1	1.6	2.5	2.1	<1	2.4	2.4
C	W09	17-Nov-14	27.9	29.2	NR	<1	<1	1.7	2.5	2	<1	2.5	2.4
C	W10	24-Nov-14	27.0	29.2	NR	<1	<1	1.3	2.2	1.5	<1	2.3	2.5
C	W11	01-Dec-14	25.9	28.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	NR	<1	1.8	1.8	2.8	1.6	<1	2	1.9
C	W13	15-Dec-14	25.1	26.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	NR	<1	<1	1.5	2.4	1.4 J	<1	1.9	2.1
TR01	W01	12-Jan-15	21.6	27.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	NR	<1	<1	1.3	1.7	1.2 J	<1	1.6	1.7
TR01	W03	26-Jan-15	21.9	30.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	NR	<1	<1	1.3	1.6	1.3	<1	1.9	2.6

NOTES:

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AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

mg/L = milligram per liter

NR = not required

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 8. Biological Oxygen Demand, 5 day (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	NR	<2	<2	29.3	R	R	<2	77.4	53.4
C	W01	22-Sep-14	30.7	44.5	NR	<2	<2	22.1	30.3	18.8	<2	29.3	28.1
C	W02	29-Sep-14	29.5	41.3	NR	<2	<2	9.4	23.8	10.3	<2	20.3	10.9
C	W03	06-Oct-14	30.2	35.1	NR	<2	<2	7.8	15.7	9.7	<2	20.1	12.6
C	W04	13-Oct-14	26.8	35.7	NR	<2	<2	2.8	7.6	4.5	<2	16.4	17.2
C	W05	20-Oct-14	29.2	35.9	NR	<2	<2	<2	3.5	2.6	<2	10.9	15.7
C	W06	27-Oct-14	27.7	43.2	NR	<2	<2	3.1	2	<2	<2	11.5	8.4
C	W07	03-Nov-14	28.8	32.0	NR	<2	<2	2	2.6	2.3	<2	8	4.7
C	W08	10-Nov-14	27.9	29.8	NR	<2	<2	2.1	2	<2	<2	9.7	3.5
C	W09	17-Nov-14	27.9	29.2	NR	<2	<2	2.9	<2	2	<2	9.6	6.4
C	W10	24-Nov-14	27.0	29.2	NR	<2	<2	3.2	4.2	<2	<2	7.8	4.2
C	W11	01-Dec-14	25.9	28.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	NR	<2	<2	5.1	3.8	<2	<2	6.5	2.6
C	W13	15-Dec-14	25.1	26.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	NR	<2	<2	5.1	2.4	<2	<2	3.6	2.4
TR01	W01	12-Jan-15	21.6	27.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	NR	<2	<2	4.9	3.1	<2	<2	5.2	<2
TR01	W03	26-Jan-15	21.9	30.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	NR	<2	<2	7.6	6.3	<2	<2	5.3	3.1

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
mg/L = milligram per liter
NR = not requrired
NS = not sampled
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
RL = reporting limit
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 9. Sulfate (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	595	579	575	603	551	571	571	497	523
C	W01	22-Sep-14	30.7	44.5	710	650	724	637	620	555 J	589	582	656
C	W02	29-Sep-14	29.5	41.3	574	615	612	605	587	565	613	573	580 J
C	W03	06-Oct-14	30.2	35.1	570	630	618	707	580	618	622	522	562
C	W04	13-Oct-14	26.8	35.7	632	637	647	660	655	648	644	615 J	612
C	W05	20-Oct-14	29.2	35.9	555	551	584	558	557	574	545	543	552
C	W06	27-Oct-14	27.7	43.2	629	614	596	625	637	673	R	602	606
C	W07	03-Nov-14	28.8	32.0	536	514	526	552	542	535	536	530	525
C	W08	10-Nov-14	27.9	29.8	616	623	640	617	644	815	627	646	657
C	W09	17-Nov-14	27.9	29.2	601	635	584	587 J	901	683	606	591	574
C	W10	24-Nov-14	27.0	29.2	638	662	636	685	749	680	654	674	638
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	645	623	633	672	687	614	663	597	625
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	673	646	707	631	668	701	652	648	645
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	670	565	582	596	600	617	678	639	801 J
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	650	608	623	617	612	609	583	652	653

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Comission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 10. Turbidity (NTU)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	18	3	5	R	44	7	8	R	R
C	W01	22-Sep-14	30.7	44.5	18	7	4	11	49	13	4	3	13
C	W02	29-Sep-14	29.5	41.3	22	8	7	8	35	35	7	7	16
C	W03	06-Oct-14	30.2	35.1	NM	7	6	9	32	48	5	6	26
C	W04	13-Oct-14	26.8	35.7	31	8	7	14	56	47	12	7	35
C	W05	20-Oct-14	29.2	35.9	39	9	8	11	60	14	11	9	103
C	W06	27-Oct-14	27.7	43.2	38	9	6	7	33	14	5	5	38
C	W07	03-Nov-14	28.8	32.0	38	9	8	5	21	3	6	3	28
C	W08	10-Nov-14	27.9	29.8	31	5	6	2	25	0	4	5	19
C	W09	17-Nov-14	27.9	29.2	30	8	7	5	23	2	8	5	25
C	W10	24-Nov-14	27.0	29.2	46	59	17	8	43	1	7	17	146
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	33	7	6	2	31	0	8	5	44
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	33	12	4	4	38	1	14	3	37
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	31	40	4	3	47	1	16	3	33
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	29	9	6	4	44	3	9	4	22
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	38	11	6	4	50	2	6	3	23

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NM = not measured
NTU = Nephelometric Turbidity Units
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 11. ORP (millivolts)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	64	151	93	-428	-296	-305	49	-444	-275
C	W01	22-Sep-14	30.7	44.5	-16	R	24	-259	-346	-277	-38	-257	-243
C	W02	29-Sep-14	29.5	41.3	-17	33	-49	-266	-272	-245	23	-265	-230
C	W03	06-Oct-14	30.2	35.1	NM	46	-26	-218	-237	-225	25	-244	-207
C	W04	13-Oct-14	26.8	35.7	32	54	-20	-192	-162	-191	-58	-226	-182
C	W05	20-Oct-14	29.2	35.9	27	65	45	-148	-51	-90	22	-180	-146
C	W06	27-Oct-14	27.7	43.2	-24	41	36	-160	-40	-60	-86	-203	-100
C	W07	03-Nov-14	28.8	32.0	27	26	34	-108	57	20	-21	-170	45
C	W08	10-Nov-14	27.9	29.8	-10	2	-29	-161	-24	-21	-43	-184	3
C	W09	17-Nov-14	27.9	29.2	26	65	61	-179	-96	-40	19	-207	-126
C	W10	24-Nov-14	27.0	29.2	21	51	29	-129	-84	20	36	-205	106
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	-26	16	19	-215	-116	-33	-49	-235	-138
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	5	45	27	-230	-152	33	59	-256	-177
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	1	50	-27	-225	-118	81	3	-232	-148
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	-28	51	6	-232	-132	43	-17	-250	-158
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	-25	37	-26	-227	-138	26	15	-221	-151

NOTES:
Values presented for physical and chemical parameters are from field measurements obtained during sampling events.
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
mV = millivolts
NM = not measured
ORP = Oxidation Reduction Potential
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 12. Dissolved Oxygen (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	5.6	5.2	6.8	0.2	0.4	0.4	5.2	0.1	0.9
C	W01	22-Sep-14	30.7	44.5	6.6	2.1	6.1	0.9	0.1	1.7	3.5	1.8	3.1
C	W02	29-Sep-14	29.5	41.3	5.9	5.7	7	1.8	1.9	2.4	6.1	0.7	3.2
C	W03	06-Oct-14	30.2	35.1	NM	6.1	6.7	2.6	1.8	1.2	5.9	1.4	3
C	W04	13-Oct-14	26.8	35.7	6.1	6.4	7.2	3.1	3.7	1.8	5.9	1.5	2.9
C	W05	20-Oct-14	29.2	35.9	3.9	6.3	6	3.1	5.4	2.5	6.1	2.1	3.4
C	W06	27-Oct-14	27.7	43.2	6	6.2	6.1	3	6.2	2.3	6	2.5	4.3
C	W07	03-Nov-14	28.8	32.0	ns	6.4	7.3	3.4	6	3.7	6.7	3.1	5.1
C	W08	10-Nov-14	27.9	29.8	6.1	6.2	7	3.6	5.6	2.5	6	1.9	2.5
C	W09	17-Nov-14	27.9	29.2	5.5	6.2	7.3	0.3	5.2	0.2	5.6	0.5	2.8
C	W10	24-Nov-14	27.0	29.2	6	6.1	7.7	1.7	5.6	1.1	5.7	0.4	3.7
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	5.7	6.2	7	1.7	6.1	2.6	5.9	1.8	3.6
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	5.6	5.9	6.9	0.6	5.8	0.7	5.9	0.3	2.6
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	5	6.5	6.9	0.4	5.9	0.8	5.6	0.3	2.5
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27.0	32.0	5.3	5.9	7	0.5	5.7	1.8	5.7	0.3	2.2
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	5.3	5.9	7.4	0.5	6.1	2.6	6.7	0.6	2.6

NOTES:
Values presented for physical and chemical parameters are from field measurements obtained during sampling events.
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
mg/L = milligram per liter
NM = not measured
OU = operable unit
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 13. Total Dissolved Sulfide (mg/L)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	R	R	R	R	R	R	R	R	R
C	W01	22-Sep-14	30.7	44.5	0	0	0	1.87	0.98	1.05	0.02	1.8	2.66
C	W02	29-Sep-14	29.5	41.3	NM	0.12	0.25	3.03	3.13	2.2	0.11	7.99	1.43
C	W03	06-Oct-14	30.2	35.1	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W04	13-Oct-14	26.8	35.7	0	0.02	0.06	51.46	4.9	2.5	0.07	R	3.67
C	W05	20-Oct-14	29.2	35.9	0.11	0.03	0.11	20.82	0.61	0.51	0.24	114.7	1.37
C	W06	27-Oct-14	27.7	43.2	0	1.77	0.56	69.24	0.05	0.09	1.88	R	3.07
C	W07	03-Nov-14	28.8	32.0	0.02	0.36	1.19	54.32	1.16	0.47	0.34	61.11	0.53
C	W08	10-Nov-14	27.9	29.8	NM	NM	NM	NM	NM	NM	0.14	434.4	0.48
C	W09	17-Nov-14	27.9	29.2	0	0.63	0.67	99.72	0.89	0.22	0.19	98.46	0.97
C	W10	24-Nov-14	27.0	29.2	0	0.39	0.88	R	1.75	0.19	0.1	4.1	3.27
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	0	0.01	1.1	R	1.46	0.06	0	62.93	3.2
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	0	0.32	0.04	20	0.51	0.1	0.17	5.9	0.17
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	0	0.07	0.11	31.25	0.42	0.11	0.33	38	1.05
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	0	0.13	0.06	30.75	1.29	0.02	0.19	31.25	1.7
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	0	0.13	0.16	6.19	0.58	0.17	0.11	9.25	0.51

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NM = not measured
mg/L = milligram per liter
OU = operable unit
R = rejected
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 14. Temperature (degrees Celcius)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H[1] (gpm)	FLOW V[1,2] (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	18.8	18.1	18.8	14.7	16.2	12.9	18.6	18.8	16.4
C	W01	22-Sep-14	30.7	44.5	20.1	19.1	19.3	17.9	19.1	17.2	19.2	18.3	18
C	W02	29-Sep-14	29.5	41.3	16.8	15.5	16.4	14.4	13.2	12.1	15.3	13.5	13.2
C	W03	06-Oct-14	30.2	35.1	NM	15.9	14	13.2	13.3	12.5	15.5	15.3	15.3
C	W04	13-Oct-14	26.8	35.7	18.7	17.4	18.3	15.5	15.5	18	17.5	17.5	19.4
C	W05	20-Oct-14	29.2	35.9	19.6	17.7	18.2	17.1	15.3	15.2	18	18.3	17.3
C	W06	27-Oct-14	27.7	43.2	18.8	17.7	17.5	15.3	15.4	12.1	18.3	17.3	17.5
C	W07	03-Nov-14	28.8	32.0	19.1	17.7	18.1	14.1	14.8	12.4	16.5	16.5	15.7
C	W08	10-Nov-14	27.9	29.8	15.7	15.9	15.7	13.3	13.1	11.3	15.1	14.7	14.9
C	W09	17-Nov-14	27.9	29.2	18.7	14.9	12.1	11.7	10.5	9.8	16.8	14.7	14.4
C	W10	24-Nov-14	27.0	29.2	18.1	16.3	12.9	5.7	8.4	9.1	15.6	15.1	14.1
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	17.6	14.4	13	12.7	9.6	10.4	15.2	14.7	15.1
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	19.2	16.1	15.5	12.1	10.9	8.9	16.7	15	13.6
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	18.9	14.5	13.2	10.6	9.2	7.9	15.1	14.9	14.4
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27.0	32.0	19.2	16.4	16.2	12.5	11.4	9.1	16.3	15.9	15.4
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	19.2	15.9	16	11.1	10	8.3	14.7	14.4	13.8

NOTES:
Values presented for physical and chemical parameters are from field measurements obtained during sampling events.
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
DEG C = degrees celcius
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
Flow H = Horizontal Treatment Train average flow rate
Flow V = Vertical Treatment Train average flow rate
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NM = not measured
OU = operable unit
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

[1] The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

[2] The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 15. Mass Removal
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Cadmium, Dissolved	19.6	<0.5	19.6	25.8	259,600	100	2.8	<0.5	19.6	33.8	340200	100	3.6
C	W01	22-Sep-14	Cadmium, Dissolved	20.2	<0.5	20.2	30.7	309,600	100	3.4	<0.5	20.2	44.5	448200	100	4.9
C	W02	29-Sep-14	Cadmium, Dissolved	22.5	<0.5	22.5	29.5	297,200	100	3.6	<0.5	22.5	41.3	416100	100	5.1
C	W03	06-Oct-14	Cadmium, Dissolved	22.3	<0.5	22.3	30.2	304,500	100	3.7	<0.5	22.3	35.1	353800	100	4.3
C	W04	13-Oct-14	Cadmium, Dissolved	23	<0.5	23	26.8	270,000	100	3.4	<0.5	23	35.7	359700	100	4.5
C	W05	20-Oct-14	Cadmium, Dissolved	23.4	<0.5	23.4	29.2	294,600	100	3.7	<0.5	23.4	35.9	361600	100	4.6
C	W06	27-Oct-14	Cadmium, Dissolved	22.7	<0.5	22.7	27.7	278,800	100	3.4	<0.5	22.7	43.2	435500	100	5.3
C	W07	03-Nov-14	Cadmium, Dissolved	20.4	<0.5	20.4	28.8	290,300	100	3.2	<0.5	20.4	32	322600	100	3.6
C	W08	10-Nov-14	Cadmium, Dissolved	22.6	<0.5	22.6	27.9	280,900	100	3.4	<0.5	22.6	29.8	300300	100	3.7
C	W09	17-Nov-14	Cadmium, Dissolved	21.4	<0.5	21.4	27.9	281,100	100	3.3	<0.5	21.4	29.2	294300	100	3.4
C	W10	24-Nov-14	Cadmium, Dissolved	20.2	<0.5	20.2	27.0	271,700	100	3	<0.5	20.2	29.2	294300	100	3.2
C	W11	01-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Cadmium, Dissolved	21.5	<0.5	21.5	25.5	257,200	100	3	<0.5	21.5	27.8	279900	100	3.3
C	W13	15-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Cadmium, Dissolved	19.1	<0.5	19.1	22.7	228,700	100	2.4	<0.5	19.1	25.7	259200	100	2.7
TR01	W01	12-Jan-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Cadmium, Dissolved	18.6	<0.5	18.6	20.4	206,100	100	2.1	<0.5	18.6	25.9	261400	100	2.6
TR01	W03	26-Jan-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Cadmium, Dissolved	18.3	<0.5	18.3	27.0	272,600	100	2.7	<0.5	18.3	32	322200	100	3.2
C	W00	15-Sep-14	Iron	4500	250	4250	25.8	259,600	94.4	597.7	246	4254	33.8	340200	94.5	783.8
C	W01	22-Sep-14	Iron	3740	170	3570	30.7	309,600	95.5	597.4	218	3522	44.5	448200	94.2	854.3
C	W02	29-Sep-14	Iron	4230	129	4101	29.5	297,200	97	659.5	210	4020	41.3	416100	95	905
C	W03	06-Oct-14	Iron	3940	134	3806	30.2	304,500	96.6	626.5	165	3775	35.1	353800	95.8	722.3
C	W04	13-Oct-14	Iron	3820	144	3676	26.8	270,000	96.2	537	154	3666	35.7	359700	96	713.4
C	W05	20-Oct-14	Iron	5730	326	5404	29.2	294,600	94.3	860.1	143	5587	35.9	361600	97.5	1093.3
C	W06	27-Oct-14	Iron	24100	1340	22760	27.7	278,800	94.4	3436.6	137	23963	43.2	435500	99.4	5642.9
C	W07	03-Nov-14	Iron	4550	297	4253	28.8	290,300	93.5	667.7	153	4397	32	322600	96.6	767
C	W08	10-Nov-14	Iron	5720	99.6	5620.4	27.9	280,900	98.3	854.8	148	5572	29.8	300300	97.4	905.1
C	W09	17-Nov-14	Iron	8800	141	8659	27.9	281,100	98.4	1316.9	260	8540	29.2	294300	97	1359.3
C	W10	24-Nov-14	Iron	5230	<50	5230	27.0	271,700	100	769.7	245	4985	29.2	294300	95.3	793.5
C	W11	01-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Iron	5710	<50	5710	25.5	257,200	100	793.7	156	5554	27.8	279900	97.3	841.6
C	W13	15-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Iron	6130	<50	6130	22.7	228,700	100	758.5	131	5999	25.7	259200	97.9	840.4
TR01	W01	12-Jan-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Iron	7510	<50	7510	20.4	206,100	100	835.1	109	7401	25.9	261400	98.5	1044.9
TR01	W03	26-Jan-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Iron	7980	<50	7980	27.0	272,600	100	1174.5	162	7818	32	322200	98	1363.7

Table 15. Mass Removal
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Iron, Dissolved	772	76.2	695.8	25.8	259,600	90.1	97.9	174	598	33.8	340200	77.5	110.2
C	W01	22-Sep-14	Iron, Dissolved	723	<50	723	30.7	309,600	100	121	128	595	44.5	448200	82.3	144.3
C	W02	29-Sep-14	Iron, Dissolved	1320	<50	1320	29.5	297,200	100	212.3	147	1173	41.3	416100	88.9	264.1
C	W03	06-Oct-14	Iron, Dissolved	625	53.3	571.7	30.2	304,500	91.5	94.1	86.2	538.8	35.1	353800	86.2	103.1
C	W04	13-Oct-14	Iron, Dissolved	339	66.1	272.9	26.8	270,000	80.5	39.9	89.4	249.6	35.7	359700	73.6	48.6
C	W05	20-Oct-14	Iron, Dissolved	575	195	380	29.2	294,600	66.1	60.5	106	469	35.9	361600	81.6	91.8
C	W06	27-Oct-14	Iron, Dissolved	1930	847	1083	27.7	278,800	56.1	163.5	113	1817	43.2	435500	94.1	427.9
C	W07	03-Nov-14	Iron, Dissolved	483	148	335	28.8	290,300	69.4	52.6	106	377	32	322600	78.1	65.8
C	W07	03-Nov-14	Iron, Dissolved	2290	79.8	2210.2	27.9	280,900	96.5	336.1	90	2200	29.8	300300	96.1	357.4
C	W09	17-Nov-14	Iron, Dissolved	1140	111	1029	27.9	281,100	90.3	156.5	188	952	29.2	294300	83.5	151.5
C	W10	24-Nov-14	Iron, Dissolved	3480	<50	3480	27.0	271,700	100	512.2	163	3317	29.2	294300	95.3	528
C	W11	01-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Iron, Dissolved	5510	<50	5510	25.5	257,200	100	765.9	161	5349	27.8	279900	97.1	810.6
C	W13	15-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Iron, Dissolved	1060	<50	1060	22.7	228,700	100	131.2	148	912	25.7	259200	86	127.8
TR01	W01	12-Jan-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Iron, Dissolved	2050	<50	2050	20.4	206,100	100	228	95.6	1954.4	25.9	261400	95.3	275.9
TR01	W03	26-Jan-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Iron, Dissolved	2260	<50	2260	27.0	272,600	100	332.6	148	2112	32	322200	93.5	368.4
C	W00	15-Sep-14	Manganese, Dissolved	2080	1760	320	25.8	259,600	15.4	45	1700	380	33.8	340200	18.3	70
C	W01	22-Sep-14	Manganese, Dissolved	2160 J	1620	540	30.7	309,600	25	90.4	1970	190	44.5	448200	8.8	46.1
C	W02	29-Sep-14	Manganese, Dissolved	2200	1500	700	29.5	297,200	31.8	112.6	2110	90	41.3	416100	4.1	20.3
C	W03	06-Oct-14	Manganese, Dissolved	2260	1750 J	510	30.2	304,500	22.6	84	2160	100	35.1	353800	4.4	19.1
C	W04	13-Oct-14	Manganese, Dissolved	2310 B	1970 B	340	26.8	270,000	14.7	49.7	2040 B	270	35.7	359700	11.7	52.5
C	W05	20-Oct-14	Manganese, Dissolved	2270	2030	240	29.2	294,600	10.6	38.2	1820	450	35.9	361600	19.8	88.1
C	W06	27-Oct-14	Manganese, Dissolved	2220	1650 J	570	27.7	278,800	25.7	86.1	1520	700	43.2	435500	31.5	164.8
C	W07	03-Nov-14	Manganese, Dissolved	2250	594	1656	28.8	290,300	73.6	260	1750 J	500	32	322600	22.2	87.2
C	W08	10-Nov-14	Manganese, Dissolved	2400	293	2107	27.9	280,900	87.8	320.4	1750	650	29.8	300300	27.1	105.6
C	W09	17-Nov-14	Manganese, Dissolved	2260	396	1864	27.9	281,100	82.5	283.5	1680	580	29.2	294300	25.7	92.3
C	W10	24-Nov-14	Manganese, Dissolved	2180	106	2074	27.0	271,700	95.1	305.2	1340	840	29.2	294300	38.5	133.7
C	W11	01-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Manganese, Dissolved	2200	232	1968	25.5	257,200	89.5	273.6	571	1629	27.8	279900	74	246.9
C	W13	15-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Manganese, Dissolved	2150	141	2009	22.7	228,700	93.4	248.6	520	1630	25.7	259200	75.8	228.3
TR01	W01	12-Jan-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Manganese, Dissolved	2070	190	1880	20.4	206,100	90.8	209.1	618	1452	25.9	261400	70.1	205
TR01	W03	26-Jan-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Manganese, Dissolved	2070	654	1416	27.0	272,600	68.4	208.4	1270	800	32	322200	38.6	139.5

Table 15. Mass Removal
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Zinc, Dissolved	3500	62.5	3437.5	25.8	259,600	98.2	483.4	148	3352	33.8	340200	95.8	617.6
C	W01	22-Sep-14	Zinc, Dissolved	3800 J	30	3770	30.7	309,600	99.2	630.9	<10	3800	44.5	448200	100	921.8
C	W02	29-Sep-14	Zinc, Dissolved	4000	<10	4000	29.5	297,200	100	643.2	279	3721	41.3	416100	93	837.7
C	W03	06-Oct-14	Zinc, Dissolved	3970	102	3868	30.2	304,500	97.4	636.7	<10	3970	35.1	353800	100	759.6
C	W04	13-Oct-14	Zinc, Dissolved	4000	53	3947	26.8	270,000	98.7	576.6	59.4	3940.6	35.7	359700	98.5	766.8
C	W05	20-Oct-14	Zinc, Dissolved	4160	69.3	4090.7	29.2	294,600	98.3	651.1	65.7	4094.3	35.9	361600	98.4	801.2
C	W06	27-Oct-14	Zinc, Dissolved	4120	47.9	4072.1	27.7	278,800	98.8	614.9	46.9	4073.1	43.2	435500	98.9	959.1
C	W07	03-Nov-14	Zinc, Dissolved	3790	54	3736	28.8	290,300	98.6	586.5	91.7	3698.3	32	322600	97.6	645.1
C	W08	10-Nov-14	Zinc, Dissolved	4230	<10	4230	27.9	280,900	100	643.3	49.4	4180.6	29.8	300300	98.8	679.1
C	W09	17-Nov-14	Zinc, Dissolved	3770	23.5	3746.5	27.9	281,100	99.4	569.8	48.8	3721.2	29.2	294300	98.7	592.3
C	W10	24-Nov-14	Zinc, Dissolved	3760	159	3601	27.0	271,700	95.8	530	54.5	3705.5	29.2	294300	98.6	589.8
C	W11	01-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Zinc, Dissolved	3900	106	3794	25.5	257200	97.3	527.4	368	3532	27.8	279900	90.6	535.2
C	W13	15-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Zinc, Dissolved	3470	38.3	3431.7	22.7	228700	98.9	424.6	26.1	3443.9	25.7	259200	99.2	482.5
TR01	W01	12-Jan-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Zinc, Dissolved	3610	42.7	3567.3	20.4	206100	98.8	396.7	25.3	3584.7	25.9	261400	99.3	506.1
TR01	W03	26-Jan-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Zinc, Dissolved	3520	52.9	3467.1	27	272600	98.5	510.3	63.7	3456.3	32	322200	98.2	602.9

NOTES:
Non detects are reported as <RL and estimated as zero for calculations and graphing.
% = percent
AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
B = Laboratory flag indicating blank contamination
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
g/day = grams per day
gpm = gallons per minute
H = horizontal
H Δ CONC = horizontal change in concentration
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.
MDL = method detection limit
NS = not sampled
OU = operable unit
ppm = parts per million
RDEFF = Rock Drain Effluent
RL = reporting limit
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
V = vertical
V Δ CONC = vertical change in concentration
VWTT = Vertical Wetland Treatment Train
W** = Week of Treatability Study Phase

The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.
The Aeration Cascade in the VWTT was bypassed on different ocassions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 16. Hydrogen Sulfide Gas (ppm)
Horizontal and Vertical Wetland Treatment Trains
St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

			H2S-01 (Aeration Channel Inlet)			H2S-02 (Access Road near Aeration Channel-South)			H2S-03 (Access Road near Aeration Channel-North)			H2S-04 (Access Road near Biotreatment Cell)			H2S-05 (Aeration Cascade Inlet)		
Phase	**Week**	**Week of**	**average**	**minimum**	**maximum**	**average**	**minimum**	**maximum**	**average**	**minimum**	**maximum**	**average**	**minimum**	**maximum**	**average**	**minimum**	**maximum**
C	W00	15-Sep-14	0.033	0	1.1	0.018	0	1.5	0.0024	0	0.2	0.000	0	0	0.002	0	0.4
C	W01	22-Sep-14	0.016	0	0.7	0.025	0	1	0.0000	0	0	0.000	0	0	0.003	0	0.4
C	W02	29-Sep-14	0.032	0	1.7	0.003	0	0.5	0.0000	0	0	0.007	0	1.1	0.004	0	0.7
C	W03	06-Oct-14	0.022	0	3	0.002	0	0.4	0.0000	0	0	0.004	0	0.7	0.006	0	0.6
C	W04	13-Oct-14	0.005	0	0.5	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W05	20-Oct-14	0.005	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W06	27-Oct-14	0.008	0	0.6	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W07	03-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W08	10-Nov-14	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W09	17-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W10	24-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W11	01-Dec-14	0.006	0	0.6	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
C	W12	08-Dec-14	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W13	15-Dec-14	0.008	0	0.7	0.000	0	0	0.0000	0	0	0.000	0	0	0.011	0	0.6
C	W14	22-Dec-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W15	29-Dec-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W00	05-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.005	0	0.4
TR01	W01	12-Jan-15	0.007	0	0.7	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W02	19-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W03	26-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
TR01	W04	02-Feb-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
TR01	W05	09-Feb-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W06	16-Feb-15	0.013	0	0.6	0.000	0	0	NA[1]	NA[1]	NA[1]	0.000	0	0	0.030	0	5

NOTES:

[1]H2S-03 Sensor was removed due to failure during calibration on 02 FEB 2015. It will be reinstalled after repairs are completed and field team is back on site.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent
AC2EFF = Aeration Cascade Effluent
BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
C = Colonization
FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
gpm = gallons per minute
HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
NA + Not available
OU = operable unit
ppm = parts per million
RDEFF = Rock Drain Effluent
SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
TR** = Test Run
W** = Week of Treatability Study Phase

Horizontal Wetland Treatment Train Summary

FEB 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

HSSF Wetland Train Report for February 2015
(Analytical data from Jan 22 and Feb 2-5, 2015)

Overall Performance

The HSSF wetland is operating very well and removes all the metals in mine water to very low levels. Additionally, the aluminum added as floculant was entirely removed by the wetland. This excellent performance has been obtained despite temperatures ranging from -18 to 12 °C (average -1.8 °C) in January and February 2015.

Settling Basin

Settling Basin No. 1 is performing very well. Turbidity levels fluctuated between 5-20 NTU for the first part of the month, but remained below 5 NTU from February 19 onward (Figure 1).

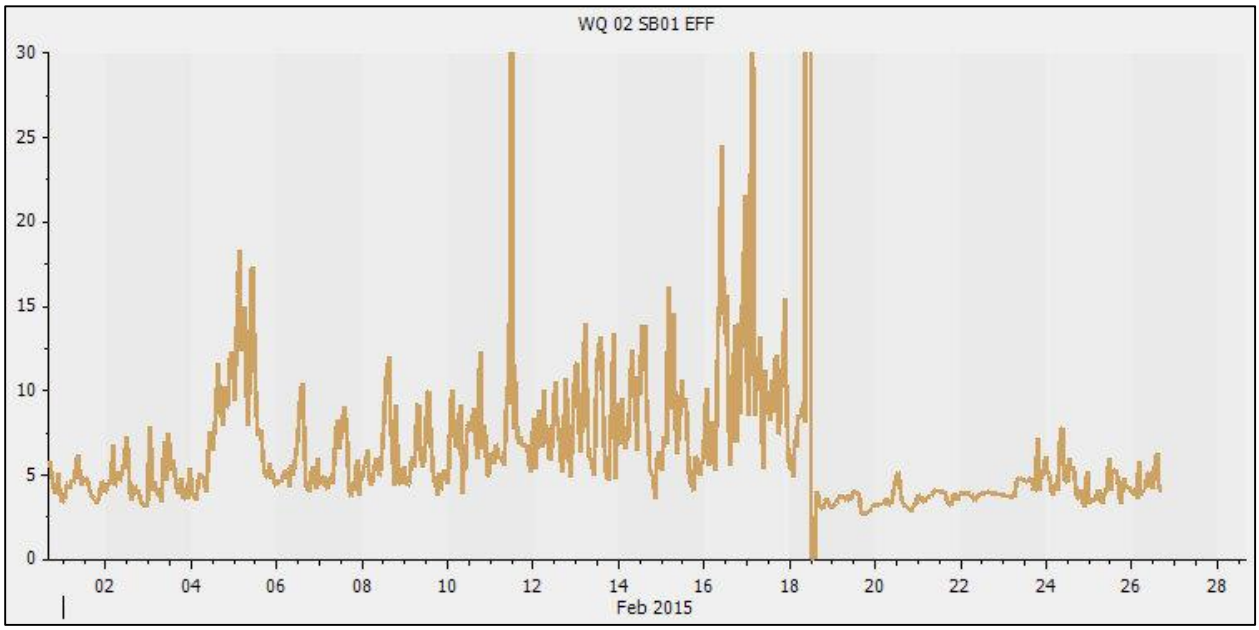


Figure 1. Turbidity measurements in SB1 effluent in February 2015.

During the February 2 sampling, total suspended solids (TSS) decreased from 20 mg/L in the SB1 influent to 11 mg/L in its effluent. Total Iron concentrations decreased from 8.0 mg/L to 1.6 mg/L in the SB effluent.

Water temperature remained consistently between 15 and 17 °C throughout February.

SF Wetland

Most water quality parameters remained unchanged or marginally improved in the SF Wetland in February. Turbidity was elevated in the wetland influent in late January (9-40 NTU), but was kept low in its effluent (4-6 NTU). This elevated turbidity was not reflected in total suspended solids (TSS) levels, which remained low throughout this time.

HSSF Wetland

The HSSF Wetland continues to show good treatment performance in February. The effluent ORP remained between -325 and -375 mV throughout February (Figure 2), reflecting optimal conditions for sulfide generation and metal removal. Other parameters (DO, pH) were also optimal.

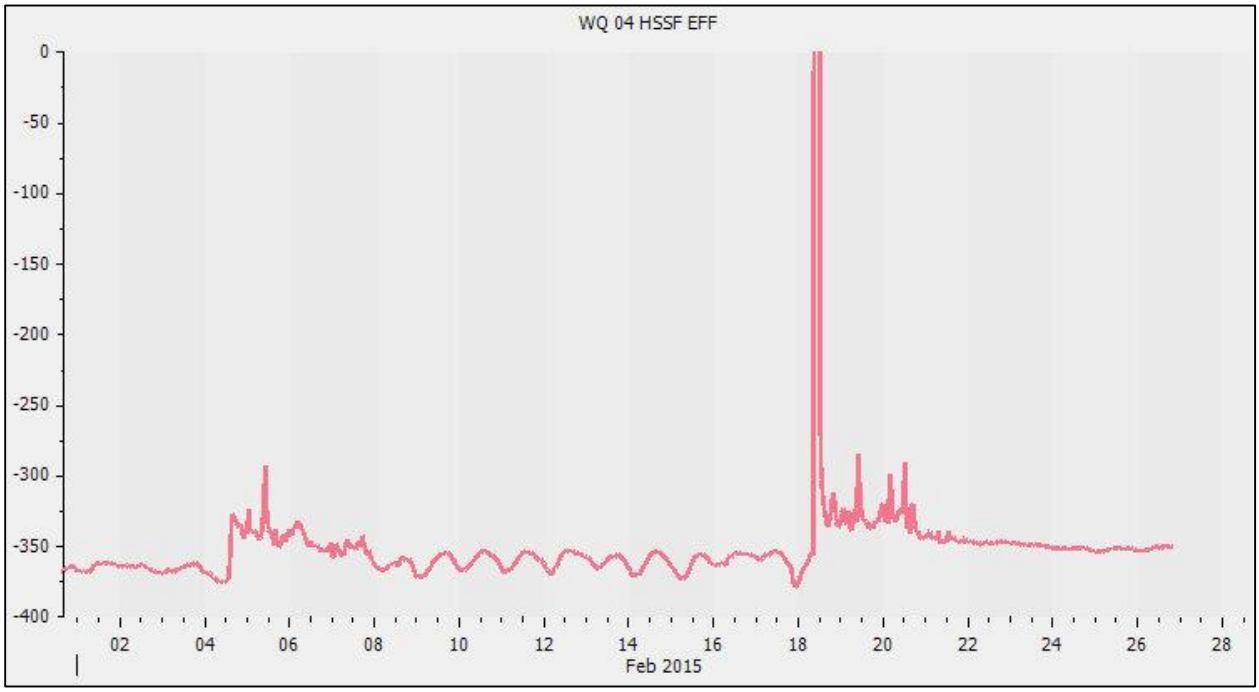


Figure 2. Effluent ORP for HSSF wetland during February 2015.

In the February sample, total cadmium and zinc concentrations decreased in the HSSF wetland by 96% and 88%, respectively. Their influent concentrations were 17.1 µg/L and 3,100 µg/L and effluent concentrations of 0.82 µg/L and 417 µg/L, respectively. The effluent dissolved zinc concentrations in the February 5 sampling was higher than before, at 129 µg/L. Otherwise, the HSSFW is achieving the lowest dissolved zinc concentrations ever observed for this system.

Copper (both Total and Dissolved) decreased in the HSSF wetland. Influent levels of total copper decreased from 10.6 and 24.8 µg/L to 3 and 4.6 µg/L, while dissolved copper decreased to < 1 µg/L. Aluminum concentrations were also elevated in the SFW effluent, but decreased to < 50 µg/L in the HSSFW. As noted before, manganese concentrations decreased in the HSSFW by approximately 50%, from average influent concentrations of 2,000 µg/L to average effluent concentration of 979 µg/L.

Biological Oxygen Demand (BOD) in the HSSFW effluent was low, averaging 6.2 mg/L.

The wetland effluent temperature has remained close between 11-12 $^{\circ}$C throughout February, despite air temperatures that plunged to -18 $^{\circ}$C. Given that treatment performance has been consistently good since last fall, this means that microbial (SRB) activity within the HSSFW is unaffected at these temperatures.

Aeration Channel

Sulfide removal has been excellent (83%) and consistent since December 2014 and it remained unchanged in February. The aeration channel does not typically polish the low metal concentration in the wetland effluent, except for iron and zinc. Their behavior was odd, in that total-iron and total-zinc concentrations increased to various degrees, while dissolved-iron and dissolved-zinc concentrations decreased by 50%. It appears that the HSSF wetland contains some colloidal iron and zinc sulfides that are oxidized in the aeration channel and rapidly precipitated into particulate iron flocs. This is reflected in the appearance of suspended solids in the aeration channel effluent, which were non-detectable in the wetland effluent but averaged 14 mg/L in the channel (data for 2015).

BOD levels entering the aeration channel were low (<10 mg/L) and did not change appreciably within the channel.

Rock Drain

Since the end of November 2014, manganese has been removed effectively by the rock drain, but there was an unexpected increase in effluent manganese concentrations in the February 5, 2015 sampling. Manganese removal averaged 80% prior to this date, but it was only removed by 30% in February. We do not know from this one sample if this is a temporary or permanent loss in performance.

Temperature in RD effluent continues to vary between 8-10 $^{\circ}$C throughout February (Figure 3). Interestingly, Figure 3 shows a decrease in water temperature of 2-3 $^{\circ}$C between February 16-19, which corresponds to decrease in air temperature of 23.3 $^{\circ}$C between February 15-17 (from 9.9 $^{\circ}$C on Feb 15 at noon to -13.4 $^{\circ}$C on Feb 17 at 4 AM, Figure 4). These data show that even large decreases in air temperature result in relatively small decreases in water temperature.

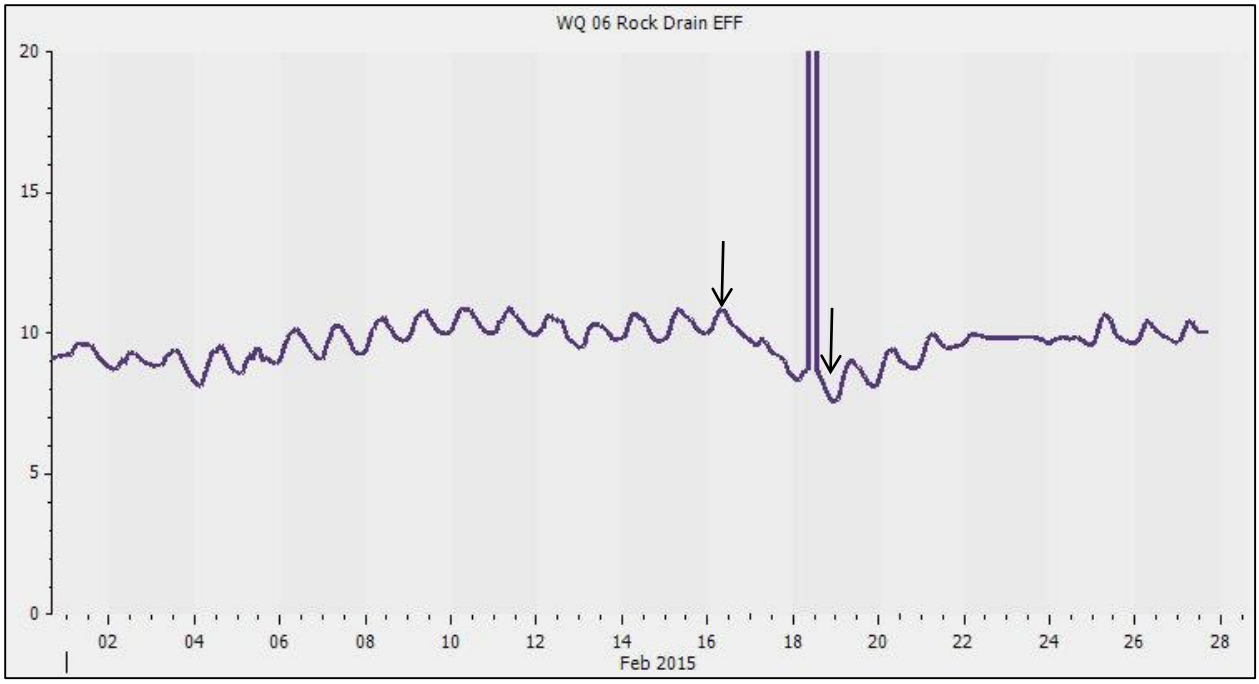


Figure 3. Temperature of RD effluent in February 2015.
Arrows denote the beginning and end of a period of decrease in water temperature.

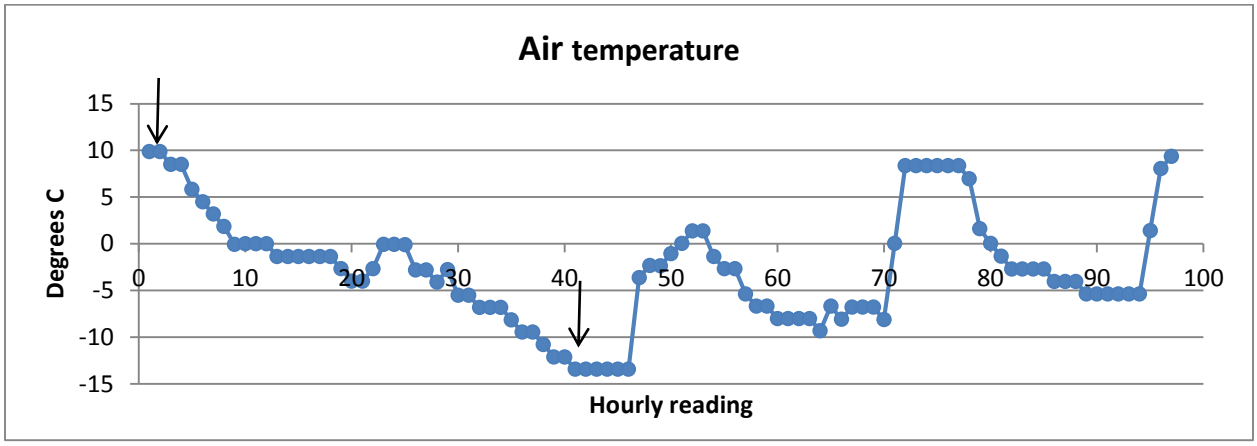


Figure 4. Air temperature from February 15 to 19, 2015.
Arrows denote Feb 15 at 12:00 and Feb 17 at 04:00, respectively.

The turbidity/suspended solids that were present in the aeration channel effluent have been completely removed in the RD.

Conclusions – HSSF Treatment Train

The HSSF treatment train is performing remarkably well, considering that this reporting period corresponds to the middle of winter, when treatment performance would be expected to be at its lowest. This provides reassurance that year-round treatment will be maintained for constant flow rates. Next, it will be important to determine what performance can be attained at higher flow rates.

Vertical Wetland Treatment Train Summary

FEB 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Rico Vertical Wetland Treatment Train Report for February 2015

Results from two VWTT sampling events that occurred on January 21 and February 4, 2015 have been received since submittal of the January 2015 monthly report. Results from these two sampling events are discussed below.

Settling Basin No. 2

Settling Basin No. 2 performance was similar to previously reported results. Turbidity decreased from an average influent level of 30 NTU to an average effluent level of 9 NTU.

Total metals removal was similar to previously reported results. Total copper, iron and lead concentrations decreased markedly, with respective average removal efficiencies of 82%, 79% and 88%. Insignificant removal was observed for cadmium, manganese, nickel and zinc. Total aluminum concentrations increased by 21%, presumably due to the presence of residual aluminum chlorohydrate coagulant. Influent and effluent arsenic results were below laboratory detection limits.

Biotreatment Cell

Total aluminum concentrations decreased from an average influent concentration of 832 µg/L to below laboratory detection limits. Total iron concentrations decreased from an average influent concentration of 1,620 µg/L to an average effluent concentration of 140 µg/L. Total lead concentrations decreased from an average influent concentration of 1.9 µg/L to below laboratory detection limits. Total cadmium concentrations decreased from an average influent concentration of 17.9 µg/L to below laboratory detection limits. Total zinc concentrations decreased from an average influent concentration of 3,250 µg/L to an average effluent concentration of 348 µg/L. Total manganese concentrations decreased from an average influent concentration of 2,065 µg/L to an average effluent concentration of 941 µg/L. Influent and effluent total arsenic results were below laboratory detection limits.

Dissolved cadmium concentrations decreased from an average influent concentration of 17.4 µg/L to below laboratory detection limits. Dissolved zinc concentrations decreased from an average influent concentration of 3,110 µg/L to an average effluent concentration of 61.5 µg/L. Dissolved manganese concentrations decreased from an average influent concentration of 2,100 µg/L to an average effluent concentration of 941 µg/L. Influent and effluent dissolved arsenic results were below laboratory detection limits.

Average effluent BOD, TOC and total sulfide concentrations were 5.3 mg/L, 1.8 mg/L and 5.9 mg/L, respectively.

Aeration Cascade

Total and dissolved concentrations of all metals were not significantly different from the average influent concentrations. Average effluent BOD, TOC and total sulfide concentrations were 3.1 mg/L, 2.2 mg/L and 1.0 mg/L, respectively.

Conclusions and Observations – Vertical Wetland Treatment Train

VWTT metals removal performance was within design expectations at design flow rates. There was a significant reversal in the high manganese removal in the biotreatment cell which was observed in December 10 and January 7 sampling events. Manganese removal efficiency declined from approximately 75% on December 10 and January 7, to 71% on January 21 and 38% on February 4. No obvious causes for the reversal have been identified. However, the biotreatment cell was not designed to remove manganese and at this time the manganese removal that was occurring is not well understood.

Wetland Plant Update

FEB 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

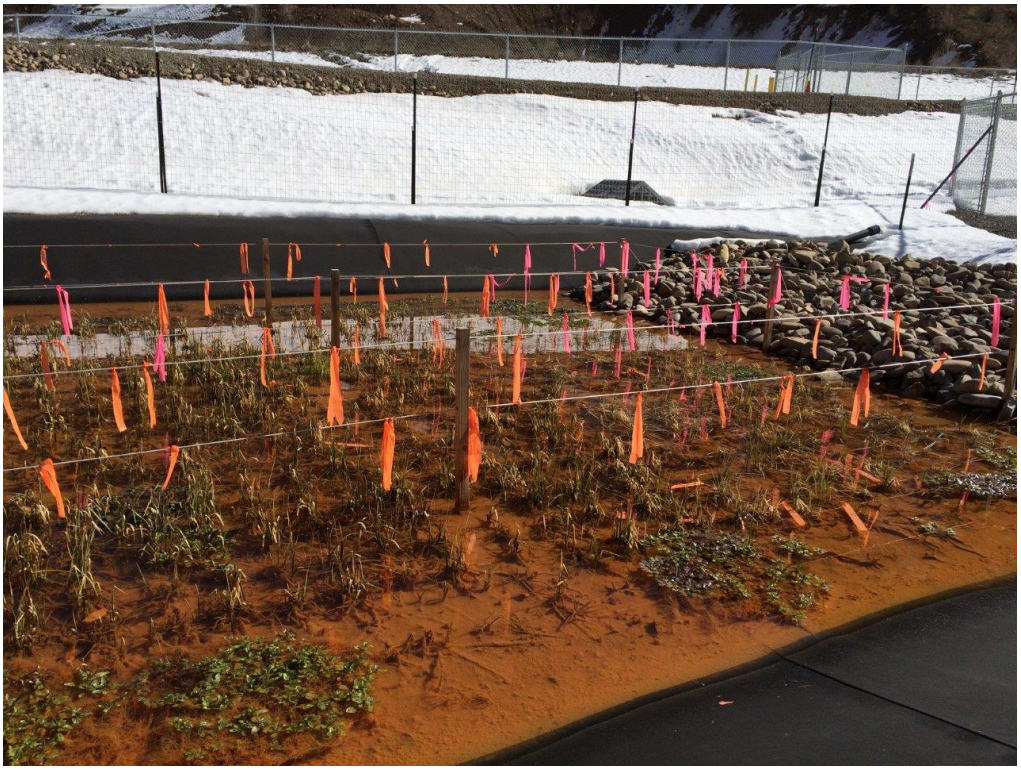
Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

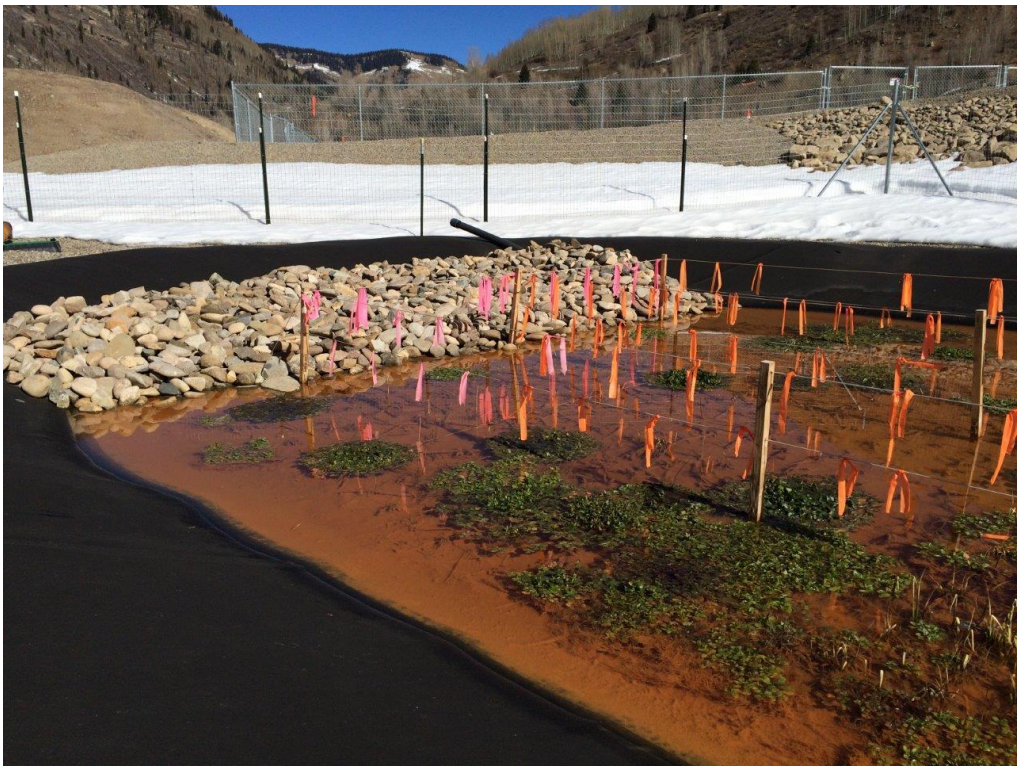
February 2015 Monitoring

Photograph 1: SF Wetland with Planted Bulrush, Sedge and Rush – Looking South on February 19th, 2015

Photograph 2: SF Wetland with Bulrush, Sedge, and Rush – Looking West on February 19th, 2015



Photograph 3: SF Wetland Looking East on February 19th, 2015



Photograph 4: SF Wetland Looking Northeast on February 19th, 2015

Photograph 5: HSSF Wetland with Establishing Wetland Plants – Looking South on February 19th, 2015

Photograph 6: HSSF Wetland –Sampling Points Comparing Vegetation
on either side of southwestern FRP on February 19th, 2015

Photograph 7: HSSF Wetland –Sampling Points Comparing Vegetation on either side of southwestern FRP on February 19th, 2015

Photograph 8: HSSF Wetland - Sampling Point Comparing Vegetation on either side of southwestern FRP on February 19th, 2015

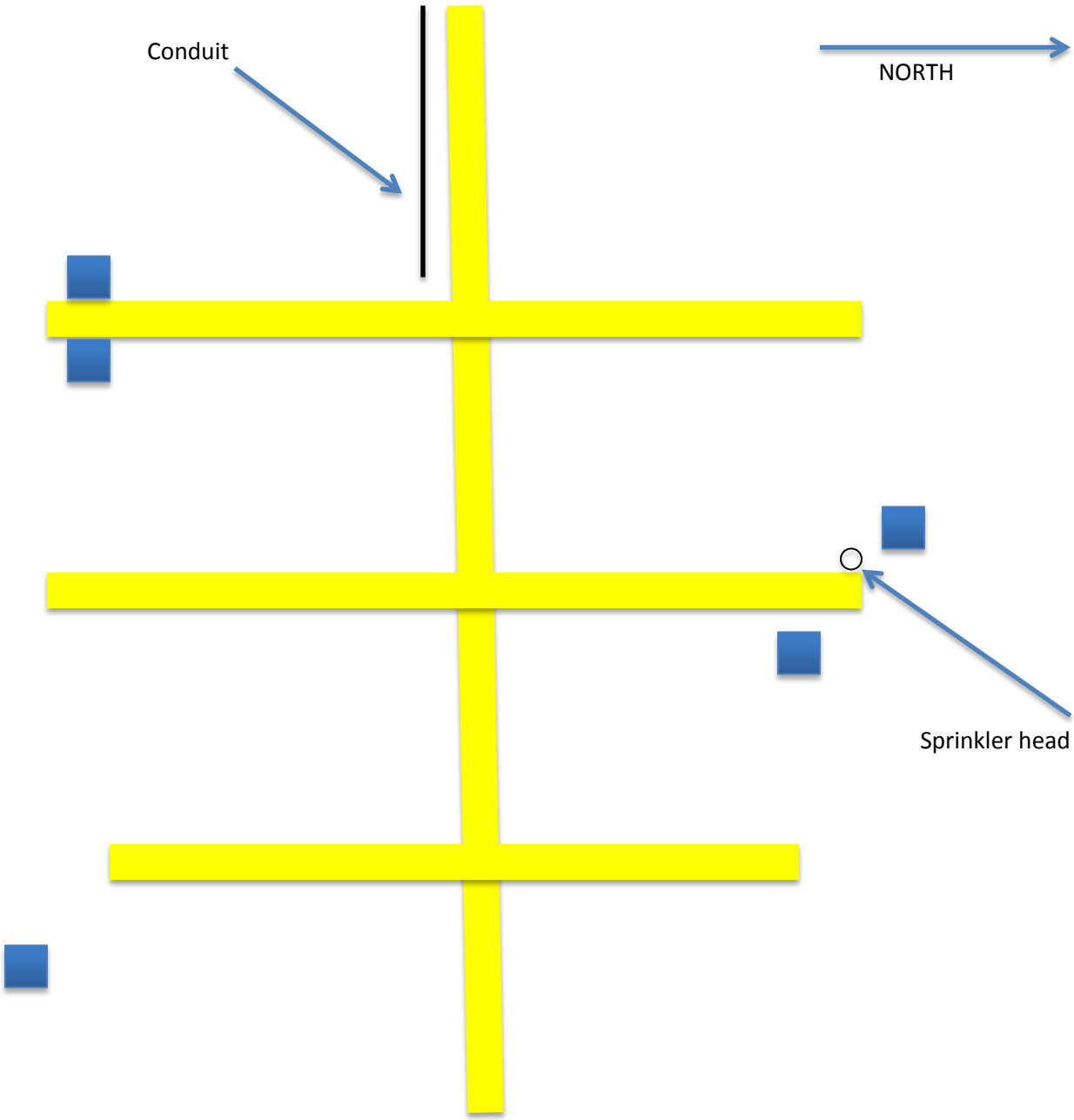
Photograph 9: HSSF Wetland – Sampling Point in Matrix –
Located east of north end of middle FRP on February 19th, 2015

Photograph 10: HSSF Wetland – Sampling Point in Northern Soil Test Strip
Reviewing Wetland Vegetation Success on February 19th, 2015

Photograph 11: HSSF Wetland – Sampling Point in Northern Soil Test Strip Reviewing Wetland Vegetation Success on February 19th, 2015

Photograph 12: HSSF Wetland – Sampling Point Located in southeast quadrant east of southeast FRP on February 19th, 2015

HSSE Wetland Plant - Monitoring Plot Locations



= monitoring plot location